

25. MORPHOLOGICAL COLOUR CHANGE IN THE MARINE CRAB, *PORTUNUS PELAGICUS* (RATHBUN)

Colour change may be morphological or physiological. In morphological colour change, the amounts of pigments which are kept constantly dispersed upon a given background increase simultaneously, whereas the amounts of pigments which are kept constantly concentrated on the same background decrease (Keeble & Gamble 1904, Babak 1913, Odiorne 1933).

According to Bowman (1942), in the crayfish, *Cambarus clarkii* after 52 days on a black background the number of white chromatophores decreased as compared to the original number, while red chromatophores increased. On a white background the converse was true. In total darkness a slight increase in chromatophore number was noted over that of normal kept in stock aquaria with brown pebble background. The prawn, *Metapenaeus monoceros* (Madhyastha & Rangnekar, 1971) when subjected to prolonged sojourn on illuminated white and black backgrounds showed a decrease and increase in the number of chromatophores respectively. Under intermittent illumination, the prawns kept on a black background showed a slight increase in the number of chromatophores, while animals on a white background did not show any change. An increase in the chromatophore number was noticed in animals kept in total darkness.

Similar experiments were carried out in the marine crab, *Portunus pelagicus*.

MATERIAL AND METHODS

Animals of both sexes ranging 8-10 cm in carapace width were selected from the stock for study. Chromatophores from the terminal part of the last periopod were counted from

an approximate area measuring 1 mm square under a compound microscope (magnification 450 X). These chromatophores were predominantly dichromatic, containing black and red, black and yellow or yellow and red pigments with a few monochromatic red, black and yellow ones. Animals were placed under the following five regimens.

- A — White background and constant illumination
- B — Black background and constant illumination
- C — White background and intermittent illumination
- D — Black background and intermittent illumination
- E — Black background and total darkness

Five animals were kept on each background in sea water which was changed after feeding the animals with crab meat on alternate days. For constant illumination "day light" fluorescent tube (20 watts) was used. Animals (group E) maintained in total darkness were kept in a dark room and were exposed to light only during the time necessary for counting their chromatophores. For intermittent illumination the animals were subjected to a day-night cycle. From all the groups, the chromatophores were counted, 7, 14, and 21 days after the commencement of experiment.

Maximal dispersion of the pigments within the chromatophores was found in the animals kept on a black background. In order to facilitate counting of those chromatophores with dispersed pigments, the experimental animals during counting the chromatophores were kept on an illuminated white background for 2

MISCELLANEOUS NOTES

hours only which resulted in a slight concentration in the chromatophores.

OBSERVATIONS

From the Table, it is evident that the number of chromatophores shows a significant increase progressively in all the animals kept on black background under different regimens.

It is also noticed that the difference between the initial reading and the final reading in the animals kept under constant illumination and black background is greater than the difference observed in animals kept under intermittent illumination and black background.

After 21 days, on a black background, the maximum increase in the number of chromatophores was observed in the animals subjected to total darkness and a minimal increase noticed in the animals under intermittent illumination, those subjected to constant illumination

on a black background occupying an intermediate position. Under these experimental conditions the animals in the three groups showed progressive increase in the number of chromatophores.

Moreover, after 21 days the chromorhiza of the chromatophores of the animals on a black background subjected to total darkness showed increased arborization and the processes of the adjoining expanded chromatophores intermingled, thereby temporarily losing their identity. This change was less pronounced in animals kept on a black background under intermittent and constant illumination. A progressive decrease in the number of chromatophores was discernible on a white background, both under constant and intermittent illumination. Moreover, taking into consideration the difference in the initial and final readings, the reduction in the chromatophore number on a white background with either

TABLE

THE EFFECTS OF DIFFERENT REGIMENS OF LIGHT AND BACKGROUNDS ON THE NUMBER OF CHROMATOPHORES IN THE MARINE CRAB, *Portunus pelagicus*

DAYS	CONSTANT ILLUMINATION		INTERMITTENT ILLUMINATION		TOTAL DARKNESS Black background
	White background	Black background	White background	Black background	
0	69.6*	52.8	62.4	58.4	56.8
	± 4.99	± 3.91	± 3.62	± 0.98	± 2.04
7	43.6	64.8	40.00	57.2	77.6
	± 1.53	± 2.33	± 2.28	± 2.24	± 1.60
14	42.4	69.6	32.8	77.6	84.00
	± 2.40	± 1.86	± 2.91	± 2.31	± 1.94
21	37.6	80.0	31.2	83.2	90.00
	± 0.97	± 2.19	± 0.55	± 1.74	± 2.16

* Each figure represents the average number of the chromatophores in an area of 1 mm square, of five animals.

constant or intermittent illumination is almost similar.

DISCUSSION

In the crab, *Portunus pelagicus* when kept, on a white background, with either constant or intermittent illumination, the reduction in the chromatophore number is almost similar. The observation that the most striking reduction in the number of chromatophores occurs under constant illumination on a white background (Bowman 1942, Green 1964, Vasantha 1968 and Madhyastha & Rangnekar 1971) is, however, not upheld in the species under investigation. The average number of chromatophores generally increases on a black background. A relatively greater increase was evident under constant illumination than under intermittent illumination. This however, is not in agreement with the findings made on the red chromatophores of the prawn, *Caridina weberii* by Vasantha (1968) and the crayfish, *C. clarkii* by Bowman (1942) and on the black chromatophores of the crab, *Ocypode ceratophthalma* by Green (1964). In the present study, in total darkness and on a black background this increase is greater than under the other two regimens. However, in the prawn *M. monoceros* Madhyastha & Rangnekar

(1971) found that, on a black background, the highest and the lowest number of chromatophores were recorded under constant and intermittent illuminations respectively, the number for total darkness occupying an intermediate position. Similar observations were also made on the red chromatophores of *C. weberii* by Vasantha (1968) and *C. clarkii* by Bowman (1942). In *O. ceratophthalma* the finding was entirely at variance as no significant variation occurred despite a treatment of 14 days. The observation that *P. pelagicus* kept under intermittent illumination on a black background has the lowest increase in chromatophore number agrees with finding made in the prawn, *M. monoceros* by Madhyastha & Rangnekar (1971).

SUMMARY

Portunus pelagicus subjected to prolonged sojourn on illuminated white and black backgrounds shows a decrease and increase in the number of chromatophores respectively. A slightly greater increase in the number of chromatophores is observed on a black background under constant illumination than under intermittent illumination. But in total darkness, on a black background the increase in the number of chromatophores is maximum.

DEPARTMENT OF ZOOLOGY,
INSTITUTE OF SCIENCE,
BOMBAY 400 032,
March 14, 1978.

D. G. KOLWALKAR
P. V. RANGNEKAR

REFERENCES

- BABAK, E. (1913): Relationship of morphological to physiological colour change in vertebrates. *Arch. ges. Physiol.* 149: 462-470.
- BOWMAN, T. E. (1942): Morphological colour change in the crayfish. *Amer. Nat.* 76: 332-336.
- GREEN, J. P. (1964): Morphological colour change in the Hawaiian ghost crab, *Ocypode ceratophthalma*. *Biol. Bull. Wood's Hole.* 126: 407-413.
- KEEBLE, F. & GAMBLE, F. W. (1904): The colour physiology of higher Crustacea. II. *Phil. Trans. B.* 196: 295-388.
- MADHYASTHA, M. N. & RANGNEKAR, P. V. (1971):

MISCELLANEOUS NOTES

Morphological colour change in the prawn, *Metapenaeus monoceros* (Fabricius). *J. Univ. Bombay Vol. XL*. No. 67: 54-59.

ODIERNE, J. M. (1933): Morphological colour change, fishes. *Proc. Nat Acad. Sci.* 19: 329-332.

VASANTHA, N. (1968): Some aspects of endocrinology of the freshwater prawn, *Caridina weberii*. Ph.D. Thesis submitted to the Marathwada University (*unpublished*).

26. EXTENSION OF RANGE OF *TRIOPS CANCRIFORMIS* (BOSC)
(BRANCHIOPODA; NOTOSTRACA: APODIDAE) TO POONCH
VALLEY (JAMMU & KASHMIR STATE)

The Tadpole shrimp—*Triops cancriformis* (Bosc) is a palaearctic branchiopod, which shows an erratic distribution, being found in several widely-separated localities such as India, England, Lombardy, Munich, Prag, Padua, Breslau, Sweden, and Bingol Dagh (Armenia). In India previous records of *Triops cancriformis* (Bosc) are from Bulandshahar, Nuriwalla, Sargodha District (Punjab), and Kashmir. The present report of *Triops cancriformis* (Bosc) from Poonch Valley (J. & K. State) is, therefore, an extension of range, *Triops* is a fairly serious pest of rice plant feeding actively on young rice plants however it does not do further harm to the plant once (the rice plant is 30 cm high) and is said to be beneficial to the plant, as it works the soil around the roots.

A large number of specimens of *Triops cancriformis* (Bosc) were collected by me from rice-fields in Poonch Valley and compared with specimens obtained from the rice-fields of Sopore and Handwara (Kashmir

Valley) as well as from Dal Lake. Detailed examinations of all these specimens have revealed that the Poonch specimens as well as those from Kashmir Valley are conspecific.

As elucidated elsewhere (Tiwari 1972, Nath 1975) the differences between the specimens of *Triops cancriformis* (Bosc) obtained from Kashmir Valley and those from the plains of India are of non-taxonomic value and are probably due to the differences in the biological conditions correlated with high altitude. Therefore, *Apus kashmiriensis* Das and *Triops cancriformis* (Bosc) are considered to be conspecific.

ACKNOWLEDGEMENTS

I am grateful to Dr. G. A. Boxshall of the British Museum of Natural History, London, for confirming the identification of the present collection, as well as to Dr. K. K. Tiwari of the Zoological Survey of India, Calcutta, for his valuable opinion.

DEPARTMENT OF ZOOLOGY,
ISLAMIA COLLEGE OF SCIENCE & COMMERCE,
SRINAGAR (KASHMIR), INDIA,
November 7, 1979.

SURENDRA NATH